



US011769713B2

(12) **United States Patent**
Mehr

(10) **Patent No.:** **US 11,769,713 B2**
(45) **Date of Patent:** ***Sep. 26, 2023**

(54) **LEAD FRAMES HAVING ROUNDED CORNERS AND RELATED PACKAGES AND METHODS**

(71) Applicant: **Microchip Technology Incorporated,**
Chandler, AZ (US)

(72) Inventor: **Behrooz Mehr,** Chandler, AZ (US)

(73) Assignee: **Microchip Technology Incorporated,**
Chandler, AZ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **17/819,460**

(22) Filed: **Aug. 12, 2022**

(65) **Prior Publication Data**

US 2022/0384316 A1 Dec. 1, 2022

Related U.S. Application Data

(63) Continuation of application No. 17/314,535, filed on May 7, 2021, now Pat. No. 11,430,718.
(Continued)

(51) **Int. Cl.**
H01L 23/495 (2006.01)
H01L 21/48 (2006.01)
H01L 21/56 (2006.01)

(52) **U.S. Cl.**
CPC **H01L 23/4951** (2013.01); **H01L 21/4821** (2013.01); **H01L 21/56** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC H01L 2924/181; H01L 23/49503; H01L 23/49548; H01L 23/49541;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,859,185 B2 1/2018 Tomie et al.
10,079,332 B2 9/2018 Fukuda et al.
(Continued)

FOREIGN PATENT DOCUMENTS

JP 2018-022772 A 2/2018
JP 2018-113312 A 7/2018

OTHER PUBLICATIONS

International Written Opinion from International Application No. PCT/US2021/070567, dated Oct. 29, 2021, 9 pages.

(Continued)

Primary Examiner — Alonzo Chambliss

(74) *Attorney, Agent, or Firm* — TraskBritt

(57) **ABSTRACT**

Lead frames for semiconductor device packages may include lead fingers proximate to a die-attach pad. A convex corner of the lead frame proximate to a geometric center of the lead frame may be rounded to include a radius of curvature of at least two times a greatest thickness of the die-attach pad. The thickness of the die-attach pad may be measured in a direction perpendicular to a major surface of the die-attach pad. A shortest distance between the die-attach pad and each one of the lead fingers having a surface area larger than an average surface area of the lead fingers may be at least two times the greatest thickness of the die-attach pad.

20 Claims, 5 Drawing Sheets

